this that he directed my attention to an allied circumstance which interested me much.

He informed me that the greatest trouble which he had was with rats, the *forest rats* he called them. They spend the winter in the garden, and, while causing a good deal of general damage, they evince a remarkable selectiveness in their taste for fruit. It appears that they have a great preference for the lemon and the mandarin, which are abundant in the garden. A number of the trees carried zinc guards on their trunks to prevent the ascent of the rats; but in a terraced garden on a steep slope there are many which cannot be protected in this way, because a rat easily jumps from a higher terrace on to the upper branches of a tree growing on the terrace below. By this means they had boarded and plundered quite a number of trees. They touched only the lemon and the mandarin trees, disregarding the common orange. But what seemed to be most remarkable was the different way in which they treated the fruits of these two trees. Of the lemon they eat the rind, removing it completely, and leaving the peeled fruit, clean and without a blemish, still attached to the branch which carried it. On one tree there were eight or ten such freshly peeled lemons still in their places on the tree, and they presented, among the others, a very curious aspect of nakedness. Having boarded a mandarin tree, the rat treats the fruit in the opposite way; he eats the inside and leaves the empty skins hanging on the tree. On one tree that I saw, nearly the whole of the fruit had been treated in this way. Something similar may be witnessed with us on gooseberry bushes in a summer when wasps are abundant. The reason for the different treatment of the two fruits is probably not to be sought further than in the fact that the inside of the mandarin is sweet and that of the lemon sour.

So long as there are mandarins and lemons, the common orange remains untouched, but when there are no more of these two they eat the common orange. By the time these are finished the fields and woods outside are beginning to furnish food, and the rats leave the garden, not to return until the winter begins again.

In answer to my inquiry, the gardener said the rats never attempt to enter the villa; they are forest rats. I asked him if they were a special kind; he said they were brown rats; and I asked him if they were different from the rats he had seen in England, and he said no.

The daintiness of the rat, shown not only in the choice of his fruit, but also in the part of it which he will eat, is not the only feature of rat life which is illuminated by the experience of the gardener of the Villa "Charles Garnier." The annual migration back and forward from the open and natural surroundings of the field and forest, where in summer food is being naturally produced in abundance, to the restricted environment of the highly cultivated garden, where in winter food is produced only by artificial devices, becomes more remarkable the longer it is contemplated. The whole area of semi-tropical garden on the Riviera is an insignificant quantity compared with that of the open ground, so that the proportion of the rat population which is able to enjoy the winter *villegiatura* must be very small, and must be chosen or evolved by a rigorous system of selection, which probably rests on the fundamental principle, the right of might.

In a fertile country like that of Liguria the rats, which are obliged to remain *fore le muri*, are no doubt able to pick up a subsistence during the winter, but they cannot afford to be so dainty as those that are able or privileged to occupy the gardens. In any case, I suppose, it may be taken to be true that a hungry rat will not hesitate to eat a healthy brother rat if he can waylay him or overcome him in combat. It is not improbable that this is the natural winter food of many tribes of rats which inhabit countries where food has its seasons of plenty and scarcity. The shortage thus produced in the winter is quickly made up by the splendid fruitfulness of the mother rats when the food season returns, and the population, over the year, need show no diminution; indeed, there is nothing to prevent it showing an increase. In nature there are accumulators of all kinds.

We have seen, on the evidence of the fruit trees of the garden, that the rats occupying it must live in that state of luxury in which the sensation of real hunger is not felt. How do they keep such a garden of Eden to themselves?

That the common oranges remain as a reserve to the end of the season shows that overcrowding is effectively prevented. We have seen that the lemon and the mandarin are preferred by the rats actually occupying the garden, and apparently indifferently, because the two fruits are consumed *pari passu*. As it is contrary to the animal nature for the strong to give way to the weak, we may feel certain that there is no relative aversion to either the lemon or the mandarin as there is to the common orange, or one of them would be consumed before the other.

All these facts go to show that the occupying force must be a very well-organised body, and must be directed by that degree of intelligence which teaches it, not only to drive and keep out strangers, but also rigorously to keep down its own numbers to the point at which it can, on the basis of experience, expect to pass the winter without being reduced to the necessity of eating common oranges.

Bordighera, March 20.

J. Y. BUCHANAN.

The Fox and the Goose.

THE interesting story concerning a fox and its fleas related by Prof. McKenny Hughes recalls one told me many years ago by an old gamekeeper on Lord Ilchester's estate at Redlynch, in Somerset. The park at Redlynch is enclosed with a rough wall about 5 feet high; the keeper's cottage is in the line of this wall.

He saw one day, whilst sitting in one of his rooms, a fox coming towards the wall carrying a goose, which it had slung over its shoulders and was holding by the neck. Upon reaching the wall it tried to jump or clamber upon it, but failed. It repeated the attempt two or three times, going back a little distance and readjusting its burden each time before doing so. Finding that it could not get over in this way, it stood on its hind legs with its front feet against the wall, and, holding the goose by the neck close to the head, pushed the bill into a crack between the stones. The goose fell down, the crack being apparently too wide. A second attempt was successful, and the bird dangled from the wall suspended by the bill at almost 4 feet from the ground. The fox then leapt upon the wall, and leaning over withdrew the bill from the chink, hoisted up the bird, and disappeared with it on the other side.

E. W. SWANTON.

Sir Jonathan Hutchinson's Educational Museum, Haslemere, March 28.

The Rusting of Iron.

IN an article in NATURE of March 2 on the rusting of iron, an objection was raised to the work of Lambert and Thomson (Trans. Chem. Soc., 1910) on the ground that their experiments were carried out in fused quartz vessels. The writer of the article puts forward the view that fused quartz dissolves in water to produce silicic acid; that the acid produced is sufficient to dissolve the iron; that enough iron will be dissolved by the process in the course of a few hours to produce, in the presence of pure oxygen, a visible quantity of ferric oxide! He cannot have supposed that the *probability* which he discusses was not considered by the authors. The object of the work was to bring together iron, oxygen, and water, all of the highest obtainable purity, and to let them react in vessels which would be least likely to affect the reaction.

It was only after most careful experiments on the suitability of quartz vessels that they were finally chosen. A long series of experiments, lasting over several months, was carried out, in which (1) fused quartz vessels, carefully cleaned, as described in the paper, (2) fused quartz vessels lined with purified paraffin wax, (3) Jena glass vessels lined with purified paraffin wax, were used under exactly the same conditions.

The experiments were carried out as described in the paper. The apparatus was evacuated down to 0·0001 millimetre (as measured by a McLeod gauge); water was distilled in from a solution of pure baryta, the conditions being such that the water which came in contact with the

iron could only have condensed on the inside of the tube in which the metal was contained.

Oxygen, made by electrolysis of pure baryta solution, was finally allowed to enter the vessels. The paraffin wax used to line the quartz and glass vessels was purified by boiling with many changes of "conductivity" water, with frequent shaking, for about 100 hours. The iron used was a commercial electrolytic sheet iron containing 99·9 per cent. iron. It was carefully cleaned with finely divided carborundum.

The results were the same in the quartz vessels and in the quartz and glass vessels lined with paraffin wax. Rusting was visible in all cases within a few hours.

It was only when pure iron, made as described in the paper, was used that no rusting took place.

After these and other experiments, it was considered that quartz vessels, which lend themselves admirably to cleaning and purification, were the most suitable vessels in which to study the reaction.

It is claimed by the authors that they have established the following facts:—(1) Pure iron does not rust when placed in contact with pure water and pure oxygen. (The term pure is used, of course, in a relative sense.) (2) The contention that "the *dominant* factor in the atmospheric corrosion of commercial iron is carbonic acid," or any other acid, is untrue. This must not be taken to mean, however, that carbonic acid plays no part in the atmospheric corrosion of ordinary commercial iron.

BERTRAM LAMBERT.
Chemical Department, University Museum, Oxford.

THE reference made to Mr. Lambert's work in my note on the rusting of iron has already proved of value in eliciting from the author a statement in reference to tests carried out in vessels lined with purified paraffin wax. His statement does not, however, provide a solution of the problem to which attention was directed, namely, that commercial iron exposed freely to air and water under the conditions described by Moody and by Friend does not rust, whereas in his own experiments rusting took place in the case of all but the most highly purified samples. It is difficult to predict whether the essential difference which still awaits discovery will ultimately be found in the iron, in the air, in the water, or in the vessel, but it is to be hoped that further discussion—in the columns of NATURE or elsewhere—may speedily throw light on this difficult and important matter.

It is a common experience, of which Mr. Lambert's work has provided excellent illustrations, that an unsuspected impurity (such as platinum in iron) is far more likely to promote than to prevent chemical change. It was for this reason that attention was directed first to the experiments in which rusting actually took place rather than to those in which it was successfully prevented. My suggestion in reference to silicic acid is correctly described, but I do not think that a note of exclamation was called for in view of the fact that mere contact with glass, as Moody found, actually produces the effects referred to, not in oxygen, but in purified air. The quantity of acid required to initiate the rusting must be extremely small, but its complete removal seems to outweigh in importance every other factor that may be taken into consideration. This view is amply supported by the fact that Friend, using common iron, common air, and the simplest apparatus, was able to stop the rusting by the simple device of washing the iron with a common alkali and then rinsing it with common water evaporated from the alkali and condensed on the iron.

With the first of Mr. Lambert's claims I am entirely in agreement; his second claim I regard as unproved and fallacious. To the statement that "the dominant factor in the atmospheric corrosion of commercial iron is carbonic acid" I adhere unreservedly, not only because the corrosion can be stopped by the addition of an alkali or by the removal of acid, but even more emphatically because the carbonic acid leaves behind an irrefutable proof of its activity in the presence of something like 10 per cent. of ferrous carbonate in the rust formed under the commonplace conditions to which I referred. T. M. L.

April Meteors.

THE following are the most important meteoric events that become due from about April 6 to April 30 in the present year:—

Epoch April 5, 21h. (G.M.T.), approximately second order of magnitude. Principal maximum April 6, 21h. 55m.; secondary maximum April 6, 1h.

Epoch April 7, 17h., eighteenth order of magnitude. Principal maximum April 9, 9h. 40m.; secondary maxima April 8, 2h. 15m., April 8, 11h. 30m., and April 9, 21h. 30m.

Epoch April 10, 17h., twenty-third order of magnitude. Principal maximum April 9, 0h. 15m.; secondary maxima April 8, 21h. 15m. and April 10, 14h. 30m.

Epoch April 11, 4h., twenty-eighth order of magnitude. Principal maximum April 11, 11h. 15m.; secondary maximum April 12, 7h. 15m.

Epoch April 13, 22h. 30m., thirty-third order of magnitude. Principal maximum April 14, 15h. 40m.; secondary maximum April 15, 14h. 40m.

Epoch April 17, 17h., twenty-ninth order of magnitude. Principal maximum April 18, 2h. 15m.; secondary maximum April 18, 4h. 50m.

Epoch April 19, 8h., twenty-fourth order of magnitude. Principal maximum April 17, 13h. 40m.; secondary maximum April 17, 21h. 45m.

Lyrid epoch April 19, 14h. 30m., approximately eighth order of magnitude. Principal maxima April 17, 20h. 50m., and April 19, 9h. 50m.; secondary maxima April 19, 9h. 30m., and April 19, 11h. 40m.

Epoch April 23, 3h. 10m., approximately sixth order of magnitude. Principal maximum April 21, 16h. 40m.; secondary maxima April 21, 3h. 55m., and April 22, 20h. 30m.

Epoch April 25, 6h. 30m., eleventh order of magnitude. Principal maximum April 23, 13h.; secondary maxima April 23, 23h. 30m., and April 24, 22h. 50m.

Epoch April 26, 6h., thirty-first order of magnitude. Principal maximum April 27, 12h. 10m.; secondary maximum April 27, 4h. 40m.

Epoch April 27, 1h., approximately tenth order of magnitude. Principal maximum April 28, 22h. 50m.; secondary maximum April 27, 23h. 50m.

Shooting stars should be numerous on April 19, as several maxima occur shortly before midnight on this date, among which Lyrids and bright meteors from allied radiants will probably be strongly in evidence. There is also another Lyrid display on the night of April 21, but it will only be partially visible on this side of the Atlantic.

April 3. JOHN R. HENRY.

Insurance against Rain.

As this scheme of insurance is one of the few of which data can be obtained by "the man in the street" from which the odds in favour of the underwriters can be calculated, I went to the trouble of investigating the matter. Possibly the results may interest your readers.

In "British Rainfall" for 1909, by Dr. Hugh Robert Mill, statistics are given of the number of days on which varying quantities of rain fell. The figures give the average for thirty-seven rainfall stations in England and Wales over a period of seven years, 1903–9. From these, by a method of interpolation, it is found that fifty-eight days in a year may be expected to show a fall of 0·20 of an inch or more, and seventy-four of 0·15 or more.

Working out the probabilities on the basis of these figures, assuming that rain on one day is independent of rain on any other day, the following results are obtained:—for every 100*l.* received in premiums the underwriters may expect to have to pay, in the case of Policy A, 66*l.*; Policy B, 74*l.*; Policy C, 43*l.*; and Policy D, 64*l.*

In favour of the underwriters is the fact that in the south and south-east, where alone the scheme is applicable, the probability of rain is less than in England and Wales generally. A further point in their favour is that the summer months are less wet than the mean of the whole year on which the above figures are calculated.

C. O. BARTRUM.
32 Willoughby Road, Hampstead, N.W., March 30.